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## USE OF COLORADO RIVER WATER IN CALIFORNIA

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IRRIGATION AND DRAINAGE
DIVISION

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# USE OF COLORADO RIVER WATER IN CALIFORNIA

Raymond Matthew
M. ASCE

## Synopsis

The Colorado River forms the easterly boundary of California extending from the Nevada State line to the international border over a distance of 246 miles. In early days this stretch of river was used chiefly for navigation of river craft bringing in supplies to the mines and related settlements. However, it is not surprising that the pioneer settlers soon turned their thoughts and energies to the possibilities of using Colorado River water for irrigation on the bordering fertile desert lands in California. Considerable time elapsed before such dreams actually matured.

The first irrigation development using Colorado River water in California was started in the seventies in the Palo Verde Valley. This was followed about the turn of the century by the much larger irrigation development in the Imperial Valley area and a smaller project near Yuma. Rights to the use of water for these irrigation developments were established by appropriation, in accordance with the recognized water law in the Western States, and these rights were among the earliest on the River.

Some twenty years later the City of Los Angeles and other cities and towns in the coastal plain region of Southern California concluded that the Colorado River offered the best source of additional water supply that would be needed soon to provide for the rapidly expanding population and industry. Accordingly, appropriative rights were initiated and plans formulated to carry out the undertaking. Since the only unappropriated flow of the River comprised flood waters, it was recognized that conservation storage would be required. At the same time it was also recognized that large storage was needed in order to meet the serious problems of damaging floods, silt, and occasional water shortages that had beset the irrigation developments. To meet these combined needs the Boulder Canyon Project was planned and carried out as a federal undertaking, including Hoover Dam, creating 32,000,000 acre-feet of storage in Lake Mead, and the All-American Canal for the irrigation of Imperial and Coachella Valleys. The Metropolitan Water District of Southern California independently financed and constructed the 350-mile Colorado River Aqueduct. All of these works have been completed and in operation for some years.

This paper outlines the history and operation of these California developments for use of Colorado River water, upon which depend the irrigation of over a million acres of land in the Palo Verde, Imperial and Coachella Valleys situated in the desert region, and the furnishing of domestic, municipal and industrial water supplies, supplementing other local and imported sources for the Metropolitan area in the coastal plain region of Southern California, embracing a present population of over 5,000,000 inhabitants.

## Introduction

History reveals that the settlements and developments of mankind have been largely influenced or controlled by climate, soil, physiography and resources -- particularly water -- and the ability to utilize those resources.

The great civilizations which evolved during the early ages, such as those in the valleys of the Tigris and Euphrates and of the Nile, were founded basically on a combination of equable climate, fertile soils and adequate supplies of water which the peoples were able to put to use for production of food supplies and for other purposes necessary to develop and sustain these civilizations.

Countless examples could be cited illustrating how such fundamental factors have influenced and controlled and developments of agriculture, commerce and industry and related settlements in the United States. Usually, if not always, water -- in streams, lakes and rivers -- and the ability to use the water, has played an essential, if not predominant role. This is perhaps particularly true in the Western States, where the arid climate in much of the region requires water not only for the production of crops by irrigation but also for domestic and industrial purposes as well.

An outstanding example of the role played by a great river in the building of a modern civilization is the Colorado River in the Southwest and particularly in Southern California (Fig. 1). If it were not for the Colorado River, Southern California could not have developed as it has. For, its growth and development, past and future, are inseparably tied to and vitally dependent upon this river as a major source of water supply, not only for the irrigation of lands in the desert region but also for domestic, municipal and industrial purposes in the metropolitan areas of the coastal plain region.

## Physiography and Climate

The Colorado River forms the easterly boundary of that portion of the State of California generally known and designated herein as Southern California. This stretch of river emerges from a canyon section near the Nevada line and extends on a comparatively flat gradient through a generally broad meandering channel, occasionally flanked by swamp and overflow bottom lands, a distance of about 246 miles to the international boundary near Yuma. To the west in California is a desert terrain interspersed by mountains and valleys, embracing about 10,000 sq. miles and separated from the coastal plain region by a high range of mountains that roughly parallel the coast line.

Precipitation is scant in the entire desert region and there is little, if any, runoff except that occasioned by infrequent cloudbursts. The coastal plain region, on the other hand, has an average annual precipitation ranging from about 10 to 18 inches, but with larger amounts in the mountains mostly in the form of snow at the higher elevations. The runoff from the several streams draining westerly and southerly from the mountains, provides a limited local water supply for this coastal region, amounting on the average to about 900,000 acre-feet annually.

A few smaller streams drain into the desert area from the mountains but the runoff from these is relatively small and is all used near the mountains for a limited amount of irrigation and for domestic supply. Consequently, the Colorado River constitutes the only major source of water supply for the desert area of Southern California, for any and all purposes.

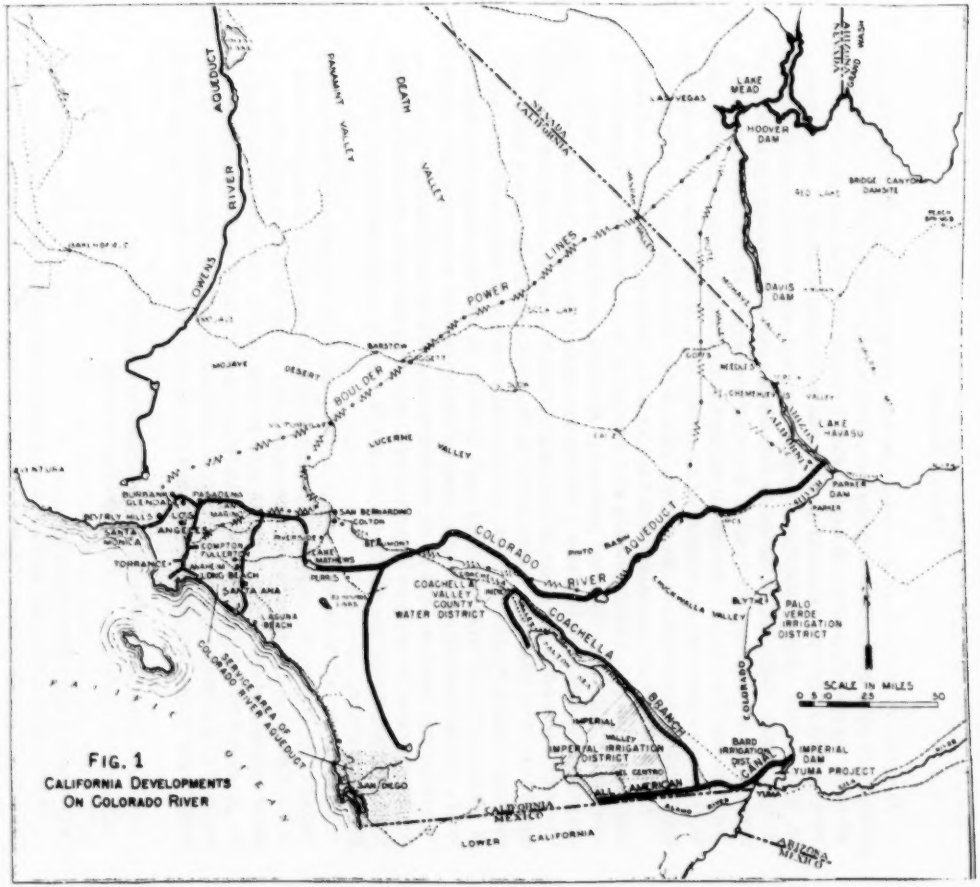


FIG. 1
CALIFORNIA DEVELOPMENTS
ON COLORADO RIVER

One of the outstanding physiographic features of the desert area is the broad fertile valley lying below sea level, a few miles to the west of the river and mostly north of the border, now known as the Imperial Valley. Under natural conditions the Colorado River occasionally flowed into this valley sink during large floods through flanking delta channels below the border.

## Early History

The history of California's developments and interests on the Colorado River is a long and interesting one covering nearly a century of progressive planning and development. It begins with a plan to divert Colorado River water to the Imperial Valley area, that was envisaged in 1849 by Dr. Oliver M. Wozencraft. This somewhat legendary individual, who was stationed at Fort Yuma in 1849, had occasion to journey across and explore the desert area to the west, along the trail of previous explorers and pioneers known as Jornada Del Muerto. As the result of his explorations and subsequent studies, he first envisaged the possibility of diverting the Colorado River to irrigate the fertile desert lands of the region later to be named the Imperial Valley.

In 1859 the State Legislature passed an Act (Chapter 234, Statutes of 1859, approved April 15, 1859) granting and conveying to Dr. Wozencraft and his associates, all right, title and interest of the State to a vast tract of land covering a gross area of about 9,000 square miles extending from the Colorado River on the east to the base of San Diego mountains on the west and from the San Bernardino base line on the north to the International Boundary on the south; provided, he and his associates, within three years from the passage of legislation by Congress ceding such lands to the State, had constructed works of "permanent and lasting quality" and furnished a "permanent supply of wholesome fresh water" at all needful stages and points along the two routes of travel from Fort Yuma to San Gorgonio Pass and to Carrizo Creek. It was provided that the works could also be used to supply water for irrigation purposes.

Dr. Wozencraft went to Washington, D.C. and labored several years in an endeavor to secure the passage of legislation by Congress ceding such lands to the State, but his efforts were unsuccessful, due in part at least to the preoccupation of Congress with matters relating to the Civil War. Although the proposed scheme did not materialize, it is significant as marking the beginning of plans to utilize Colorado River water in California, and as the forerunner of the plan which was actually carried out some forty years later.

## California's Developments for Use of Colorado River Water

### Palo Verde Valley Development

California's active interests in and rights to the use of water from the Colorado River date from the seventies when water was first appropriated for the Palo Verde area. In 1877 Thomas Blythe acquired about forty thousand acres in the Palo Verde Valley under the Swamp and Overflow Act, and made a water filing in the amount of 95,000 miners inches on July 17, 1877, which was followed by numerous additional filings in subsequent years, for irrigation and other purposes in the Palo Verde Valley and adjoining lands. The original Blythe filing, as far as known, is the first of record on the lower Colorado River.

Due to numerous difficulties irrigation development proceeded slowly under private and mutual organizations. The present Palo Verde Irrigation District was created by special act of the Legislature in 1923. The district embraces an area of about 100,000 acres bordering and extending along the river for nearly 30 miles. Approximately 16,000 acres of adjoining mesa lands are about to be added to the district. Substantially two-thirds of the lands in the existing district are now under irrigation and the irrigated area is continuing to expand.

Imperial Valley Development

The largest irrigation development in the desert area of Southern California is that of the Imperial Valley area which was initiated in the nineties. The first filing was made on May 16, 1895, by E. I. Rockwell for 10,000 second feet of Colorado River water for the irrigation of the Imperial Valley area in the United States. This was followed by several subsequent filings, one of which contemplated irrigation of the Coachella Valley area as well as the Imperial Valley area. All these filings have been maintained in good standing and were transferred to Imperial Irrigation District upon its organization.

In 1892 an engineer, C. R. Rockwood, after making a reconnaissance along the Alamo River to Salton Sink, organized, with associates, the Colorado Irrigation Company. This was succeeded in 1896 by the California Development Company, which was organized to develop the Imperial Valley, with C. R. Rockwood in charge of engineering and construction. Initial diversion from the Colorado River to the new canal was made in May, 1901, and in June, 1901, irrigation began in the Imperial Valley.

Although the canal diversion was within the United States, for practical reasons the canal had to be located and constructed through the territory of Mexico en route to the Imperial Valley, and accordingly it was necessary to get a concession from the Mexican Government. This concession, which was obtained in May, 1904, through a Mexican subsidiary of the California Development Company, provided that water from the canal should be made available and delivered for the irrigation of lands in Lower California up to one-half the volume of water passing through the canal.

In 1904 and 1905 floods broke through the headings of the canal and water flowed through the canal into the Salton Sea with disastrous results. Efforts to close the break were not successful until 1907. The Southern Pacific Company, which was interested not only in the development of the Imperial Valley but also in the protection of its railroad around the Salton Sea, took over the work of closing off the river and it was through its efforts and financing that the break was finally closed.

As a result of this disaster, the California Development Company got into financial difficulties. Its management and operations were taken over by the Southern Pacific Company in 1905 and it went into receivership in 1909. The Southern Pacific Company acquired the company's entire system both in Mexico and the United States at a receiver's sale in February, 1916.

The Imperial Irrigation District was organized in 1911 with an area of 523,000 acres. In June, 1916, the California Development Company's canal system was purchased by the district from the Southern Pacific Company, including irrigation facilities in Mexico. In subsequent years the district at its own expense constructed a system of levees in Mexico to protect the Imperial Valley from the recurrent floods of the Colorado River, and in addition, improved the canal system.

The political obstacles encountered in constructing and operating this system were almost as serious as the physical difficulties. The Mexican concession was unsatisfactory in many respects, aggravated by unstable political conditions in Mexico. As a result, efforts to obtain a substitute diversion canal which would be entirely in United States territory were early initiated. Numerous surveys and investigations were made, culminating in a report on the All-American Canal issued in 1919 by a board consisting of Elwood Mead, W. W. Schlecht, and C. E. Grunsky. In the same year a bill was introduced in Congress by Congressman Kettner to authorize construction of the canal. This was the forerunner of the Boulder Canyon project.

Coachella Valley Area

Irrigation of the Coachella Valley area was early contemplated in conjunction with the Imperial Valley development. However, it was not included in the area irrigated by the works constructed by the California Development Company as subsequently enlarged and extended by the Imperial Irrigation District.

Nevertheless, irrigation started in the Coachella Valley in 1902 with water supplies obtained from the artesian basin underlying the valley. There followed a gradual expansion of the irrigated area, accompanied by a substantial increased use of underground water. As a result of this expansion, coupled with the relatively small water supply, artesian pressures and underground water levels gradually subsided. Realization of the fact that the underground supply was being drawn upon in excess of replenishment convinced the landowners in the valley that remedial measures would be essential. In 1918 the Coachella Valley County Water District was organized for the initial purpose of conserving local supplies and replenishing the underground basin. The fully conserved local water supply is far from sufficient, however, to serve the irrigable area in the valley. Accordingly the district immediately turned its attention to the Colorado River as a source of water supply, and cooperated with the Imperial Irrigation District in planning and promoting the All-American Canal and Boulder Canyon dam.

Yuma Project in California

Another early development providing in part for the irrigation of lands in California from the Colorado River is the Yuma Federal Reclamation Project which was authorized in 1904. This was one of the first projects authorized under the Reclamation Act of 1902 and the first thereunder on the Colorado River. In addition to lands in Arizona, the project covers a gross area of about 25,000 acres in California, including valley lands lying within the Yuma Indian reservation. Irrigation started in 1907, and about 10,000 acres are now under irrigation in California. The present area irrigated lies partly within the Bard Irrigation District which was organized in 1927.

Other Proposed Irrigation Projects

In addition to the foregoing irrigation developments, a number of potential projects for irrigation of lands in California from the Colorado River were early investigated and proposed. These included projects for irrigation of lands in the Mojave, Chemehuevis, Parker and Chuckwalla Valleys, and on the Palo Verde Mesa.

Altogether, including existing and proposed projects, plans had been definitely made or were under consideration, prior to the twenties, for irrigating lands in California from the Colorado River, aggregating nearly 1,500,000

acres and involving an estimated net annual use of Colorado River water of 6,250,000 acre-feet.

Metropolitan Area of Southern California

Prior to the turn of the century, the intensive irrigation developments and the cities and towns throughout the coastal plain area had obtained the necessary water supplies for irrigation, domestic and municipal use, by the development of local surface and underground water supplies.

The first importation of water into the area was undertaken by the City of Los Angeles which initiated the construction of works for bringing in a water supply from the Owens River in 1907. The Owens River Aqueduct was completed in 1913 with a capacity of 400 second-feet. It was thought at the time that this imported supply would solve the city's water problem for many years to come. However, rapid growth of population and other factors combined to prove otherwise, and less than 10 years later it became evident that the combined local and imported supply would become inadequate within 10 to 15 years.

It was in the early twenties that William Mulholland, then chief engineer of the water department of the City of Los Angeles, envisaged the idea of going to the Colorado River for an additional water supply. After considering various other possible sources, it was concluded that the Colorado River was the only adequate source for the additional water supply needed. Preliminary surveys were initiated in 1923 which established the general feasibility of bringing water in from the Colorado River. On June 28, 1924, the City of Los Angeles filed an application to appropriate 1,500 second-feet of water from the Colorado River. During the next five years intensive surveys and studies of alternate diversion routes were carried out under the direction of Mr. Mulholland and H. A. VanNorman by the City of Los Angeles.

During 1924 general sentiment developed for the construction of an aqueduct from the Colorado River which would benefit all of the metropolitan areas of Southern California. The Colorado River Aqueduct Association was organized to sponsor the project. Through the efforts of this association an act was passed by the Legislature and approved by the Governor on May 10, 1927, authorizing the organization of metropolitan water districts.

The Metropolitan Water District of Southern California was incorporated on December 6, 1928, following an election on November 6th of that year held in the several cities proposed to be included in the proposed district. The 11 cities which voted approval and were included in the district, comprised the following: Beverly Hills, Burbank, Glendale, Los Angeles, Pasadena, Santa Monica, San Marino, San Bernardino, Colton, Anaheim and Santa Ana. San Bernardino and Colton subsequently withdrew. Permanent organization of the district was effected in 1929. In 1931 the cities of Compton, Fullerton, Long Beach and Torrance joined the district and these four, combined with the former nine remaining, comprise the "13 original cities."

According to the first annual report of the Metropolitan Water District, issued in 1939, the Colorado River Aqueduct was planned "not as a Los Angeles project, but as a Southern California enterprise, not on the basis of meeting immediate needs alone, but on the far broader basis of insuring for generations to come an adequate water supply for the region as a whole." The ultimate aqueduct capacity was fixed at 1,500 second-feet, based upon a thorough study of population trends and probably growth of domestic and industrial water demands in the metropolitan area of the south coastal basin, comprising approximately 2,200 square miles of habitable area.

It was estimated by the district that a supply from the Colorado River of 1,000,000 acre-feet annually in combination with full practicable development and utilization of local supplies and the importations from the Owens River augmented by an additional supply from Mono Basin, would provide a total gross supply for this general metropolitan area of approximately 1.4 acre-feet per acre. As pointed out in that report, this amount of water considered for irrigation purposes is a modest supply, and it is low considered as a domestic supply even for sparsely settled sections and makes no allowance for heavy usage in congested and industrial areas. It is evident that the amount of water contemplated to be imported from the Colorado River by the Metropolitan Water District represents the very minimum which will be needed to provide an adequate supply to meet the growth of population and industry in the area served for the immediate years ahead. It is now recognized that additional water from other sources will be required in the not distant future for maximum ultimate development of the coastal plain region.

The City of San Diego was also modest in considering what its needs might be for Colorado River water to supplement local sources of supply. On April 15, 1926, the city filed an application to appropriate 155 second-feet of water from the Colorado River. Its plans for which subsequent provision was made contemplated an aqueduct to bring in to San Diego and vicinity 112,000 acre-feet annually of Colorado River water. In the light of recent population trends in San Diego and vicinity, this is obviously a small amount considering the relatively limited local water supply that can be made available under full practicable development. Additional water from other sources will be required to provide for maximum development of San Diego County.

## Boulder Canyon Project

Prior to and during the early twenties, California agencies initiated and formulated plans to augment the water supply of Southern California, by storage and diversion of water from the Colorado River, and incidentally, for development of hydroelectric power. These plans were subsequently crystallized and carried out by the Boulder Canyon Project and its related developments.

This project was the outgrowth of the varied combined needs of Southern California. Its initiation and planning came as a logical step in the development of the Colorado River to provide necessary control, conservation and regulation of the waters of the Colorado River for California developments. It had its initial impetus in the studies and investigations surrounding the proposal of an All-American Canal. But its further impetus and final scope grew out of other important necessities in addition.

By the twenties, rights had been perfected to the use of Colorado River water embracing the entire low water flow of the stream along the borders of California. Junior appropriations upstream combined with subnormal flow in dry years had resulted in many instances of substantial shortages in water supply for the existing irrigation development in the Imperial Valley. On the other hand, there were recurrent floods which were not only a menace to the developed irrigated lands along the river and in the Imperial Valley, but also resulted in large amounts of water being wasted into the Gulf of California.

In addition, the silt problem in connection with these irrigation developments was becoming more serious year by year, involving not only large expense in the maintenance of the canal facilities, but also jeopardizing the

continued successful irrigation of the lands and materially adding to the flood menace. It has been stated that unless some means could have been found to control the silt of the Colorado River, irrigation of lands from the lower river might have been faced with abandonment within a few years.

Although the junior appropriators upstream might have been enjoined, such litigation would have been long and costly and it was decided that efforts should be directed to a more constructive solution to obtain adequate water supplies as well as other important benefits. It was recognized that storage would be needed to regulate and conserve the flood waters in order to obtain an adequate supply not only for irrigation but also for importation into the metropolitan areas of Southern California, and to provide for control of floods and silt.

In order to meet these combined needs the Boulder Canyon Project was conceived and promoted by the several Southern California agencies concerned, actively supported by most of the citizens and organizations of Southern California and throughout the State. Numerous investigations and reports were made by various federal agencies, particularly the Bureau of Reclamation. The most important of these reports was the Fall-Davis Report of 1922, authorized by the Kincaid Act of 1920, which for the first time recommended the joint authorization of Boulder Dam and the All-American Canal. It was followed by a comprehensive report by F. E. Weymouth, issued in 1924, in which the plans for the storage dam (now Hoover Dam) and the All-American Canal were crystallized substantially as subsequently carried out.

Swing-Johnson Bill

The initial legislation in connection with further development on the Colorado River was the so-called Kettner Bills which were introduced in 1919 and 1920 but failed to come to a vote. These sought only to authorize the construction of the All-American Canal, but were the forerunner of the larger Boulder Canyon Project.

The first bill providing for the authorization of the Boulder Canyon Project was introduced in April, 1922, by Congressman Phil D. Swing and Senator Hiram W. Johnson, and became known as the Swing-Johnson Bill. The bill was amended and reintroduced in subsequent years during its consideration by Congress.

The fourth and final bill was introduced on December 5, 1927, and after substantial amendment was finally passed by Congress and approved on December 21, 1928.

Boulder Canyon Project Act

The Boulder Canyon Project Act provided for the construction of a storage dam and power plant at Black Canyon or Boulder Canyon of not less than 20,000,000 acre-feet capacity, and the All-American Canal. It authorized construction of the dam to be started when the Secretary of the Interior had executed contracts for sale of water and power, which would assure repaying in 50 years the entire cost of the dam and power plant with 4 percent interest together with operation and maintenance expenses, etc. It also authorized construction of the All-American Canal to be started when the Secretary had executed a contract for repayment, without interest, of its cost under the provisions of the Reclamation Law. It provided that there should be no charge for water or for the use, storage, or delivery of water for irrigation and domestic use in the Imperial and Coachella Valleys.

Another prerequisite to starting construction of the project was ratification of the Colorado River Compact by the States of the Colorado River Basin, in accordance with alternative provisions specified by the Act. Because at that time Arizona refused to approve the Compact, the requirements of the Act in this regard were met by six-state approval coupled with the passage of an Act by California limiting its use of Colorado River water, known as the California Limitation Act. Detailed discussion of the background and provisions of that Compact, the limitation act and related legal matters is purposely omitted as being too involved for proper consideration herein and outside the intended scope of this paper.

Power Contracts

In 1930 power contracts were executed by the Secretary of the Interior with the Metropolitan Water District of Southern California, the City of Los Angeles Department of Water and Power and the Southern California Edison Company, Inc., and others. Under these contracts, all of the firm power output of the Hoover Dam power plant was disposed of and commitments made to purchase all of the power, at a price which was fixed largely on the basis of competitive cost of steam-generated power and which would yield a revenue calculated to be sufficient to meet the capital and annual costs of the dam and power plant, including interest.

Water Contracts

During the period from 1930 to 1934, contracts were executed under the terms of the Project Act by the Secretary of the Interior with the several Southern California agencies concerned, for storage and delivery of water from Hoover Dam Reservoir (Lake Mead), in an amount aggregating 5,362,000 acre-feet annually, divided by agreement among the several agencies as follows:

| Priority No. | | Agency and description | Annual quantity in acre-feet |
|---|---|---|---|
| 1. | | Palo Verde Irrigation District--104,500 acres in and adjoining existing district. | |
| 2. | | Yuma Project (California Division)--Not exceeding 25,000 acres -- | --3,850,000 |
| 3. | (a) | Imperial Irrigation District and lands in Imperial and Coachella Valleys to be served by All-American Canal ---------- | |
| | (b) | Palo Verde Irrigation District--16,000 acres of adjoining mesa- | |
| 4. and 5. | | Metropolitan Water District*, City of Los Angeles and/or others on coastal plain------ | 1,212,000 |
| 6. | (a) | Imperial Irrigation District and lands in Imperial and Coachella Valleys to be served by All-American Canal ---------- | -- 300,000 |
| | (b) | Palo Verde Irrigation District---16,000 acres of adjoining mesa-- | |
| | | Total ---------- | 5,362,000 |

*Includes San Diego County Water Authority which became part of Metropolitan Water District in December 1946 and to which original contract rights of City of San Diego were transferred at same time and merged with those of Metropolitan Water District.

It was considered at the time the water contracts were executed and is still considered by the State of California and the several agencies concerned, that the aggregate amount of water contracted for, namely 5,362,000 acre-feet per annum, is well within the California Limitation Act to which reference has been made heretofore.

## Construction and Operation

The execution of the power contracts guaranteeing repayment of capital and annual costs of Hoover Dam and power plant set the machinery in motion for appropriation of funds for construction to proceed. Construction work on the dam proper started in 1931. The dam was completed to commence storing water in February 1935, and the power plant was placed in operation for delivery of commercial power in October, 1936.

The contracts executed by the Imperial Irrigation District, the Coachella Valley County Water District, and the City of San Diego, in addition to covering delivery of water from Hoover Dam Reservoir, provide for repayment of the cost of the All-American Canal in an amount not to exceed $38,500,000.

Construction of the All-American Canal unit of the Boulder Canyon Project was started in 1934. On February 13, 1942, the All-American Canal commenced the delivery of all of the Imperial Irrigation District's water supply, and use of the old Imperial Canal through Mexico was discontinued except for Mexican service. Construction of the Coachella Branch Canal was started in 1938, and completed for initial operation in 1949.

The All-American Canal contemplates and is designed to irrigate over a million acres of land in the Imperial and Coachella Valleys. The capacity of the main canal below Pilot Knob is 10,000 second-feet divided 8,500 second-feet to the Imperial Irrigation District and 1,500 second-feet to the Coachella Valley County Water District.

The Imperial Irrigation District is the largest single operating irrigation project in the United States. It comprises more than 900,000 acres in gross area, of which about 500,000 acres are now irrigated and producing crops, and about 250,000 acres remain to be developed for irrigation.

The Coachella Valley County Water District, with about 135,000 acres of irrigable lands in the northern end of the Imperial Valley is now served by the All-American Canal. Approximately 75,000 acres are presently being developed for irrigation by means of a concrete pipe distribution system under construction by the United States Bureau of Reclamation. Irrigation development is proceeding rapidly.

In addition to the work undertaken by the Federal Government, the construction of the Colorado River Aqueduct was undertaken and financed directly by the Metropolitan Water District of Southern California. A bond issue of $220,000,000 was voted by the people of the district on September 29, 1931. Construction on the aqueduct was started in 1933, and on Parker Dam in 1934. The main aqueduct to Lake Mathews was completed in 1940 and water delivered into that reservoir. Since that year the aqueduct has been functioning and water has been delivered to certain member cities.

A branch aqueduct has been constructed connecting the Colorado River Aqueduct to San Diego. It was completed and placed in operation in December, 1947, providing for about half the ultimate capacity needed. Construction of a second barrel to complete the San Diego Aqueduct was started in 1952.

The Metropolitan Water District since the beginning of operation has continued to grow by further annexations. The district now (1952) comprises 20 municipalities and districts including, in addition to the original 13 cities, the following districts: Coastal, Chino, Eastern, Orange County, Pomona Valley, and West Basin Municipal Water Districts, and San Diego County Water Authority, which together include 32 additional cities, making a total of 45 cities in the district. More annexations are pending. Use of Colorado River water has been continuously increasing and all additional requirements of the metropolitan areas on the coastal plain will be served from this source, up to the limit of the district's rights.

## Present Use of Colorado River Water in California

The amount of Colorado River water now (October 1951 to October 1952) being used in California, in terms of "net diversions"* from the River, is estimated to aggregate about 4,210,000 acre-feet annually, based upon preliminary figures issued by the Bureau of Reclamation, divided as follows:

| | Acre-Feet Annually |
|---|---|
| Palo Verde Irrigation District | 317,000 |
| Yuma Project, California | 15,000** |
| Imperial Irrigation District | 3,195,000 |
| Coachella Valley County Water District | 496,000 |
| Metropolitan Water District | 187,000 |
| Total | 4,210,000 |

The use has been increasing year by year and it is expected to progressively increase up to the full amount of the rights established by appropriation and contract, within a reasonable period of years.

Prospective increased use in the Imperial Irrigation District has been delayed pending studies in progress of the additional lands to be put under irrigation.

Use of Colorado River water in the Metropolitan Water District service area has been relatively small thus far. However, it is expected to expand rapidly in the future, due to the fact that all additional needs for domestic, municipal and industrial water supply in the area served must be met from the Colorado River supply. It is estimated that the 1,212,000 acre-feet of Colorado River water that the district plans to use, combined with other present local and imported sources, will take care of a total population of about 8,000,000, or about double the present population in the cities and local districts now included in the Metropolitan Water District of Southern California.

## Conclusion

The foregoing history reveals step by step the story and background of California's rights and interests in and to the use of Colorado River water, from the first appropriation and use of the waters to the completion of the Boulder Canyon Project and related works and facilities -- a history covering a period of progressive planning and development of nearly a hundred years.

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Notes: *"Net diversion" equals gross diversion from, less return to Colorado River.

** Reflects in part return flow from All-American Canal, which is not properly credited to this project. Actual net diversion estimated at approximately 30,000 acre-feet.

Southern California agencies expect to obtain and use the full amount of Colorado River water to which its agencies have established rights by appropriation and use or by contract under the terms of the Project Act; namely, 5,400,000 acre-feet annually in round figures, divided among the several agencies as set forth in the water delivery contracts. It was in anticipation of these benefits and in reliance on this amount of water that Southern California agencies made commitments and investments aggregating already substantially $550,000,000. The main works and facilities are already constructed and in operation to utilize the entire amount of water covered by these established rights.

The full realization of those developments that have been made for use of Colorado River water in California is vital to the present and future economy, not only of Southern California but also the entire State.